PROJECT SUMMARY

Texas Department of Transportation

# 0-6983: North Texas Bicycle and Pedestrian Crash Analysis

## Background

In the last 5 years, more than 2,700 pedestrians and 270 cyclists lost their lives in crashes on Texas roadways, which accounts for approximately 17% of all traffic fatalities (FARS 2013-2017). With the national goal to achieve a significant reduction in traffic fatalities and serious injuries on all public roads, and the state and local safety performance targets in place, this research project conducts a holistic investigation of the causes of pedestrian and bicycle crashes based on 5 years of historical data from Texas' largest metropolitan planning area, the North Central Texas Council of Governments (NCTCOG).

## What the Researchers Did

This project's goal was to update the existing mixture The research team was tasked to use the Pedestrian and Bicycle Crash Analysis Tool (PBCAT) crash typing methodology developed by the University of North Carolina for the Federal Highway Administration (FHWA, 2006). PBCAT builds upon more than 40 years of research investigating the causes of crashes that involve pedestrians and cyclists. The research team reviewed 10,002 crash reports that involved a pedestrian or a pedalcyclist in the NCTCOG area during a 5-year period between 2014 and 2018. A PBCAT crash type was assigned based on the narrative and crash diagram of each crash following the crash typing methodology of the PBCAT version 2.0. A procedure to automatically populate other PBCAT database fields from Crash Report Information System (CRIS) Automated Crash Data Public Extract files was developed to reduce the data entry time. In cases where roadway-related data was not available in CRIS data fields, the TxDOT Roadway Inventory Annual Data (TxDOT, 2017) was queried. Additional data was gathered from existing datasets related to the surroundings of the crash, including population and employment density, vehicle ownership, worker commute mode-share, land use, as well as the location of schools, parks, transit stops, and bikeways.

Descriptive trend analysis was conducted to explore the impact of various factors (such as roadway elements, conditions, and actions prior to the crash) on frequency and severity of crashes. The most common PBCAT crash types for bicyclists and pedestrians were identified. Multinomial logit (MNL) models were developed to determine the factors that contribute to a higher likelihood of a crash resulting in a fatal or severe injury.

High-incidence crash corridors were identified for pedestrian crashes and for bicyclist crashes. Screening methods included Kernel Density Estimation (KDE) Cluster Analysis (Bíl, 2019), and Optimized Hotspot Analysis. Report cards were prepared for the top 61 pedestrian crash corridors and the top 45 pedalcyclist crash corridors. They provide information about what city and county the corridor is located in, its length, crash history based on 2014-2018 data, roadway elements, impairment, surrounding conditions, identified PBCAT crash groups, and a list of potential countermeasures based on the PBCAT crash type. This summary is meant for local districts and municipalities to help identify areas that need further safety analysis.

The research team presented guidelines to enhance pedestrian and pedalcyclist safety by adopting a comprehensive approach to select cost-effective countermeasures to reduce the frequency of crashes. These guidelines aim to assist state, regional, and local organizations in the development of strategic plans to foster safety management practices at the network level. The comprehensive approach involves a process of four steps: Step 1. Identify high-risk crash locations, Step 2. Determine risk safety factors and crash types, Step 3. Select cost-effective safety countermeasures, Step 4. Implement countermeasures and monitor for safety effectiveness.

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An on-line pilot application, the Crash Data Analysis and Visualization Application (CDAVA), was developed to organize, curate, and present the results of this project. CDAVA includes a database with all data that was gathered during this project, crash locations, identified crash corridors, and their report cards. A 'query' feature allows authenticated CDAVA users to quickly identify locations of crashes by year, TxDOT district, county, city, person type, gender, age, injury severity, alcohol, and drug impairment, on/off-system, midblock/intersection, and light conditions. Additionally, an extended set of filters is available in the advanced query section.

## What They Found

The most common crash types observed in the North Texas dataset were similar to those reported in PBCAT crash studies in Arizona (ADOT, 2017), Michigan (Michigan OHSP, 2016), and Wisconsin (WisDOT, 2006). *Crossing Roadway* (with vehicles *not turning or turning*) lead to the highest number of fatal and serious crashes, as well as *Unusual Circumstances*, such as *Disabled Vehicle-Related* crashes. *Crossing Expressway* resulted in fatal and serious injuries in 70% of crashes. For pedalcyclists, *Motorist Overtaking Bicyclist* led to the highest number of fatal and serious crashes.

A multinomial logit (MNL) model, looking into significant factors that may contribute to fatal or serious severity of a crash, was developed based on data from 7,047 pedestrian crashes and 2,958 pedalcyclist crashes. Thirteen factors were considered significant for the Pedestrian MNL model and these include roadway elements (Posted Speed, presence of Traffic Control), conditions (Driver Age, Pedestrian Age, Light Condition, and presence of a Freight Truck), and actions prior to crash (Motorist Maneuver, PBCAT Crash Group, Drug Positive, Alcohol Positive, Pedestrian Position and PBCAT Intersection). Six factors were considered significant for the Pedalcyclist MNL model and these include: roadway elements (Posted Speed), conditions (Driver Age, Pedalcyclist Age, Light Condition), and actions prior to crash (PBCAT Crash Group, and Bicyclist Direction).

## What This Means

There are a number of potential applications of the results from this research. The procedure developed for PBCAT analysis can lead to recommendations on what fields could be included in future versions of the crash report form CR-3, and the lessons learned in the development of the crash database, methodology applied to identify high-incidence crash corridors and recommended cost-effective countermeasures can be leveraged in existing state and local efforts.

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